First beamtime results for PANDA EMC barrel prototype Proto 120*

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Introduction

In 2014 the PANDA Barrel EMC prototype Proto 120 was tested during a beamtime at MAMI in Mainz. The mechanical design and construction was done by IPN in Orsay. The carbon alveoles and associated tools were produced by the laboratory of IHEP in Russia. The KVI group in Groningen designed and built the differential line driver. GSI delivered the charge sensitive preamplifier ASICs (APFEL ASIC [1]) with rigid flex PCBs and the signal distributor boards which was developed for PANDA. The integration of the components, the cooling setup and the operation of the prototype during the beamtime was done by the II. Physikalisches Institut of the Giessen University. The goal of the beamtime was to identify the system energy resolution with particular focus on the APFEL - ASICs developed at GSI.

Readout Electronics

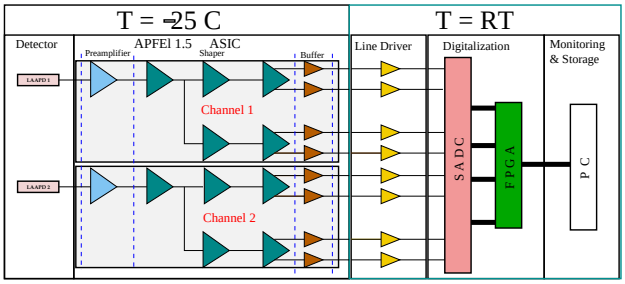

Figure 1: Readout architecture for each crystal of the EMC prototype Proto120.

Figure 1 shows the used readout architecture. Each detector crystal is covered by two large area APDs (LAAPDs) read out by the APFEL 1.5 ASIC. For better resolution the crystals, LAAPDs and the ASICs were cooled down to T = $-25°$C. The differential output signals from the ASIC were buffered with the 100 Ohm line driver and digitized by the sampling ADC (SDAC). The triggered events can be monitored online and are stored for a detailed analysis.

Measured Results

For the first test of the PANDA Barrel Proto 120 only small matrix of 3×3 crystals was assembled and measured. After analysis the detailed results were presented at the workshop in Rauischholzhausen by C.Rosenbaum from Giessen University [2].

The focus was to determine the energy resolution as a function of the injected energy. Tagged photons with known energies were used to calibrate each crystal first. Accordingly the beam was injected to the central crystal and the data of the hole matrix was read out with the in figure 1 presented architecture. Unfortunately two crystal readouts were not working. Figure 2 shows a comparison between the latest measurement and the results of the former test setup Proto 60. To take the two missing crystal readout into account the corresponding channels have been masked in the analysis of the Proto 60 data.

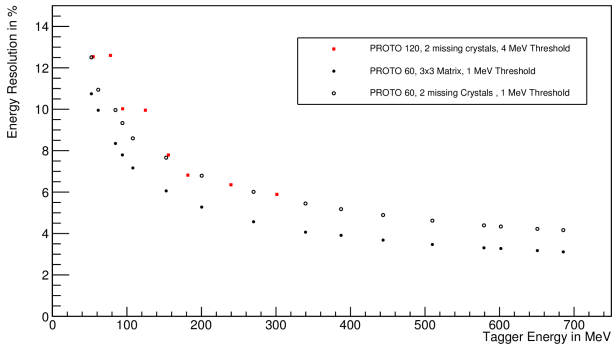

Figure 2: Energy resolution as a function of tagger energies for different PANDA EMC prototypes [2].

The different setups show an equivalent energy resolution. To improve the setup performance of Proto120 a new riged Flex PCB with electrical modification concerning detector biasing and shielding was developed and produced for the next beamtime.

Summary and Outlook

After the successful beamtime 2014 an additional beamtime in spring 2015 is forseen to measure a complete working 3×3 and additionaly a 4×4 matrix. Afterwards the final decision for the ASIC mass production will be fixed.

References

[1] P. Wieczorek and H. Flemming, “Low Noise Preamplifier ASIC for the PANDA EMC”, IEEE Nuclear Science Symposium 2010, Knoxville, USA, NSS-N47-74, Published in NSS/MIC, 2010 IEEE

[2] C. Rosenbaum, ”Status on PROTO 120”, EMC Workshop Rauischholzhausen, 24 November 2014

* Work supported by EU (contract number: RII3-CT-2004-506078) cooperation with FAIR@GSI PSP code:14110.

DOI:10.15120/GR-2015-1-MU-HADRONS-16